Research Interest 'versus' Patient Autonomy -- Conflicting Tensions in the History of Brain Stimulation Approaches

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Further Open Access Literature on the topic can also be found in the University of Calgary Institutional Repository at:

https://dspace.ucalgary.ca/handle/1880/47274/browse-title

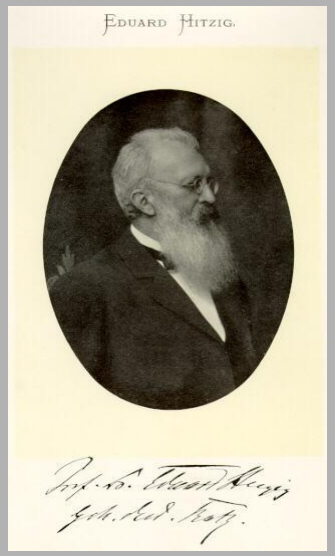
Numerous Diagrams and Images about modern Deep Brain Stimulation and Surface Brain Stimulation approaches can be found in: J. Classen and A. Schnitzler (eds.): *Interventionelle Neurophysiologie*, Stuttgart: Thieme (2012).

1) Brief Overview of current-day DBS methods and some ethical problem fields

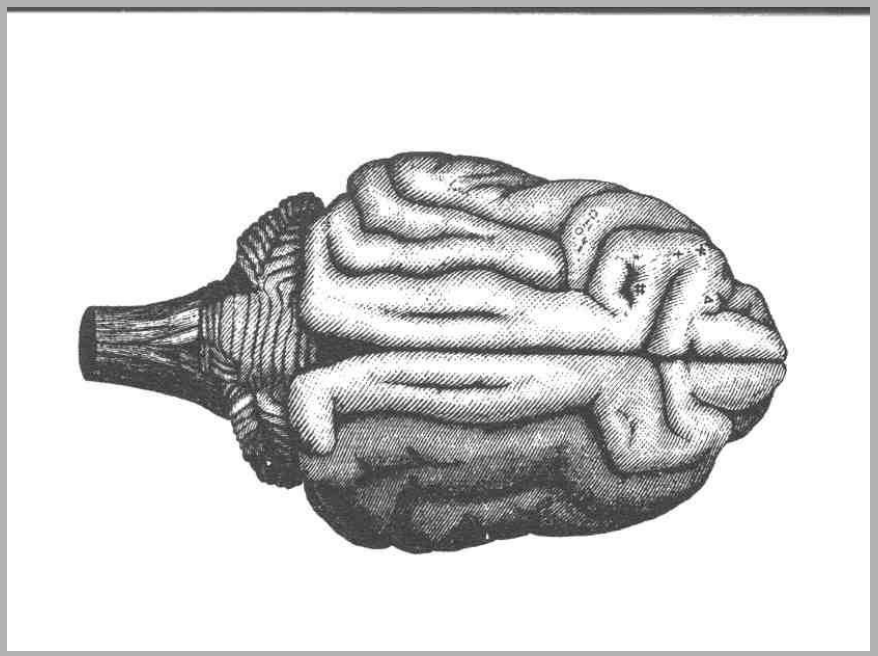
2) Tracing some research trajectories that lead to Deep Brain Stimulation (DBS) and Surface Brain Stimulation (SBS) since the 1920s and 1930s

3) Addressing various ethical problems that have been related to the historical comparison of traditional and modern approaches in DBS and SBS

Modern Neurostimulatory Approaches



Fritsch and Hitzig (1870)



Melzack and Wall (1965):

"Gate Control Theory"

(Images are in the Public Domain)

"Decade of the Brain" Campaign (1990-2000)

“Neuroethical exceptionalism”:

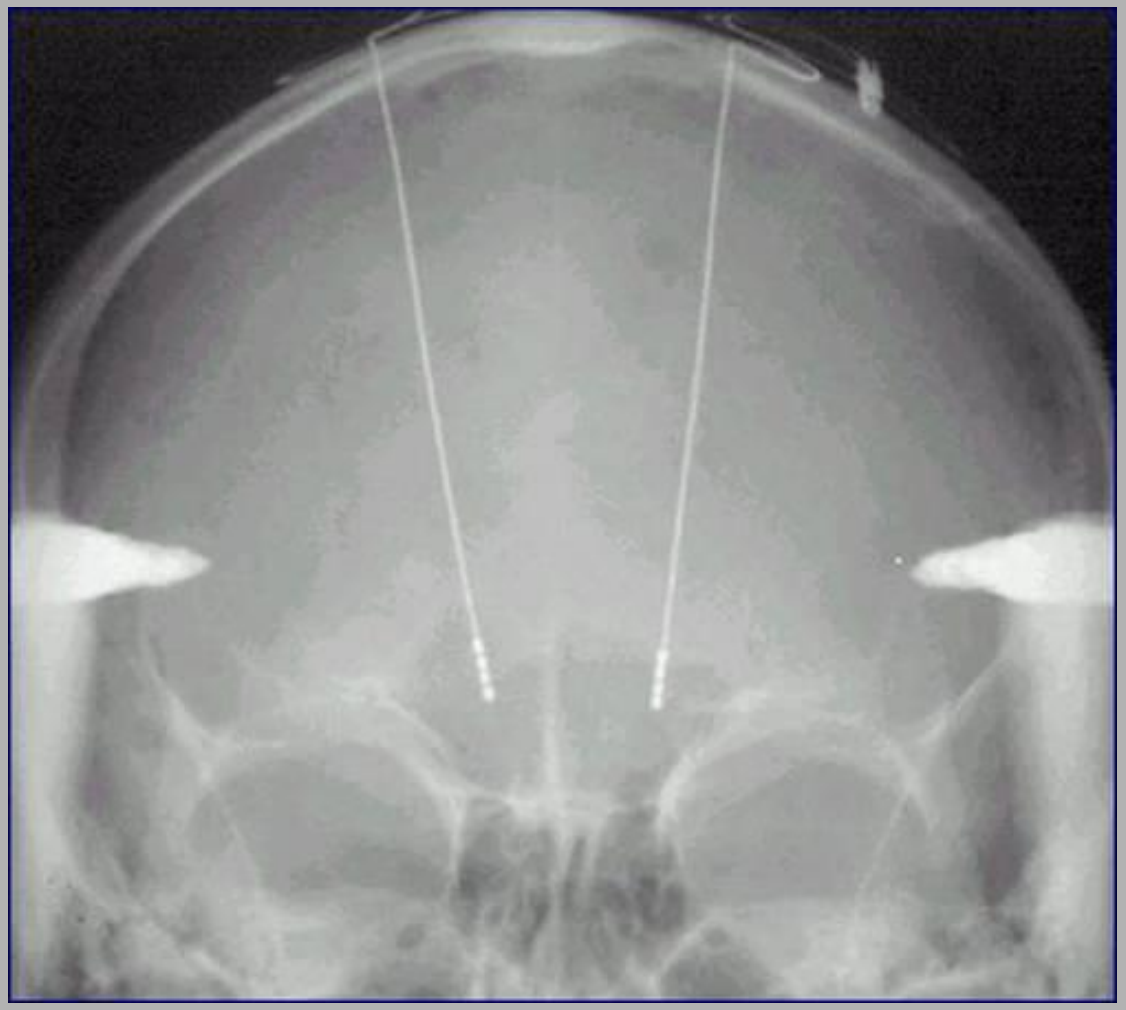
… a special status of neuroethical considerations with regard to medical ethics and bioethics …

(Judy Illes and Eric Racine; *The American Journal of Bioethics,* 2005)

Mayo Clinic, Rochester, MN: "*Parkinson Patient after Deep Brain Stimulation Surgery*"

http://www.youtube.com/watch?v=a1xdB1jNBu8&feature=results_main&playnext=1&list=PL6413BAC3F79760FB

Stereotactical operation device from Kopf Inc. (based on Spiegel and Wycis, 1947)



X-ray showing the stimulation electrodes in nuclei of the thalamus (image courtesy of Dr. T. Haelbig, New York / Berlin)

Ethical and knowledge problems:

- Insufficient knowledge of the functional influences
- The causal mechanisms and elements of the circuitry are not fully known
- There is still no consent as to what the best loci of stimulation are
- Alterations of behaviour and emotions have only recently begun to be researched as well
- Questions have been raised as to the DBS' impact on memory and even decision-making processes in the treated patients

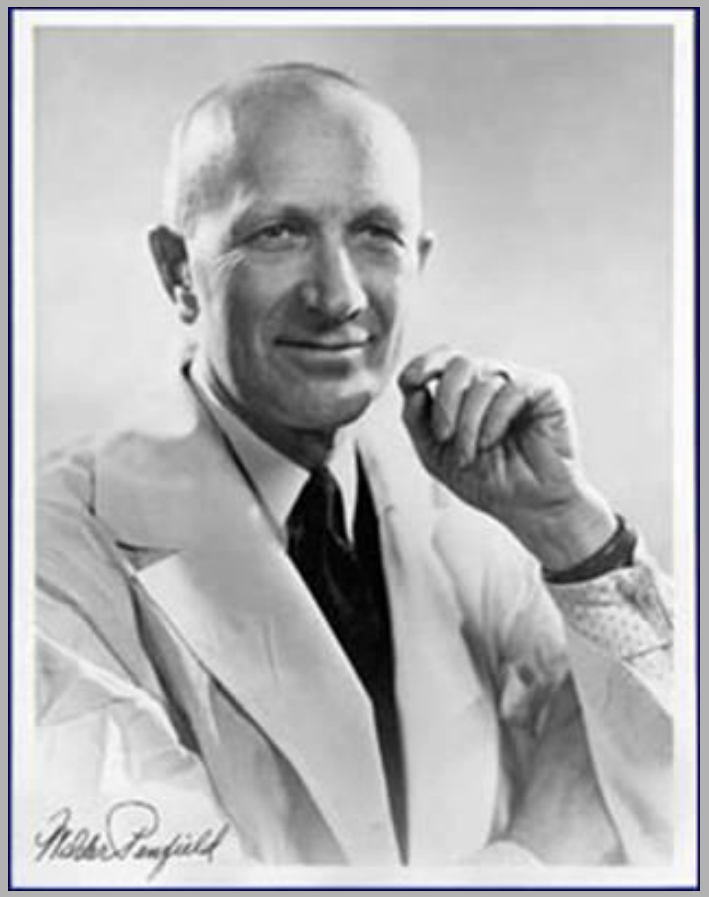
(Image is in the Public Domain)

"Our motivation was always therapeutic."

Robert Galbraith Heath
(1915-1999)

"We followed the paths of our teachers and mentors."

Wilder Penfield (1891-1976)



(Image is in the Public Domain)

A Historical Comparison with Clinical Research on Brain Stimulation since the 1920s and 1930s

Otfrid Foerster (1873-1941)

(Image is in the Public Domain)

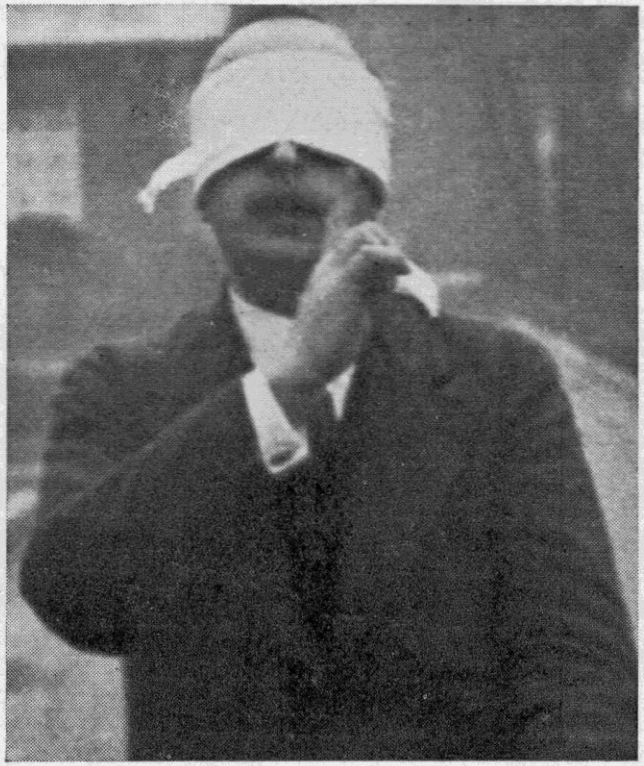


Abb. 1. Vorbeizeigen.

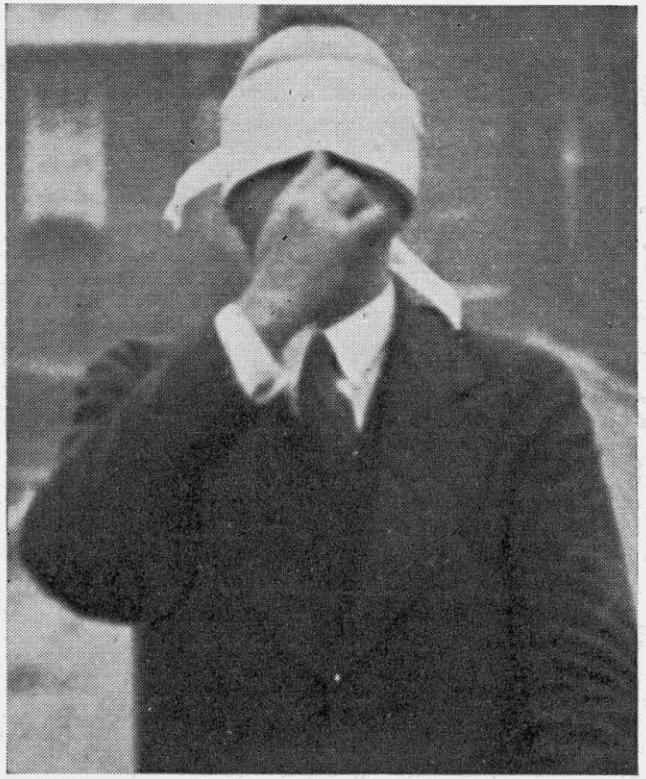


Abb. 2. Richtiggreifen.

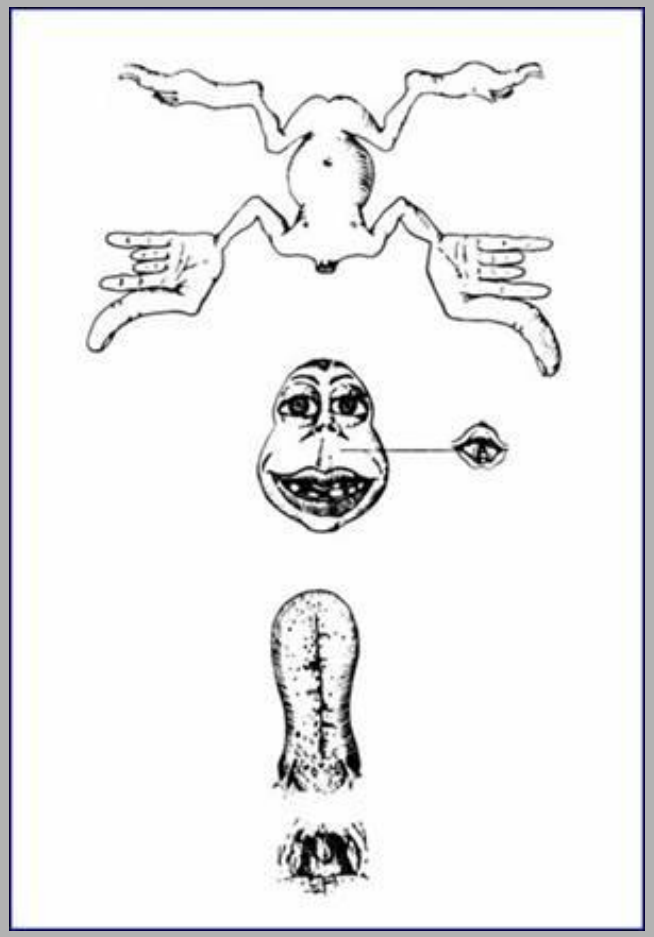
Diagnostic neurological tests in a head-wounded veteran during the early 1920s.
(Reproduced after: F. W. Stahnisch and T. Hoffmann, 2010)

"Foerster's clinic [in Breslau] is above all a clinic in which therapy takes first place. Syphilis of the central nervous system is treated energetically by the Swift-Ellis endolumbar method in addition to the other usual procedures. Intracarotid injections of salvaranized serum likewise freely used. Physio- and hydrotherapy are carried out vigorously in the special rooms which are well equipped for that purpose. The wards are pleasant but the nursing is not of the highest order and decubitus is too frequently seen. […] Diagnosis is thorough. Encephalography is very frequently used and in the 1500 cases of spinal injection of air there seem to have been very few bad reactions. Direct ventriculography is also frequently used as well as lipiodal and the ventricular injection of dyes […]"

(W. Penfield, 1928, p. 7)

"[…] Physiological diagnostic procedures also find a place here in a remarkably well equipped laboratory for chronaxie and other electrical measurements. […] Practically all of [Foerster's] operating has been done under local anaesthesia. Thus he has used the patient as a witness to pain localization, has outlines areas of skin innervation and has determined the movements of the body which follow electrical stimulation of various areas of the cerebral cortex. This analysis of the cortical areas has made possible an intelligent advance in the treatment of epilepsy. His study of the pain paths has made it possible to relieve certain types of pain more intelligently. […] **Above all, here Neurology is accompanied by therapy.**"

(W. Penfield, 1928, p. 7, emphasis added)



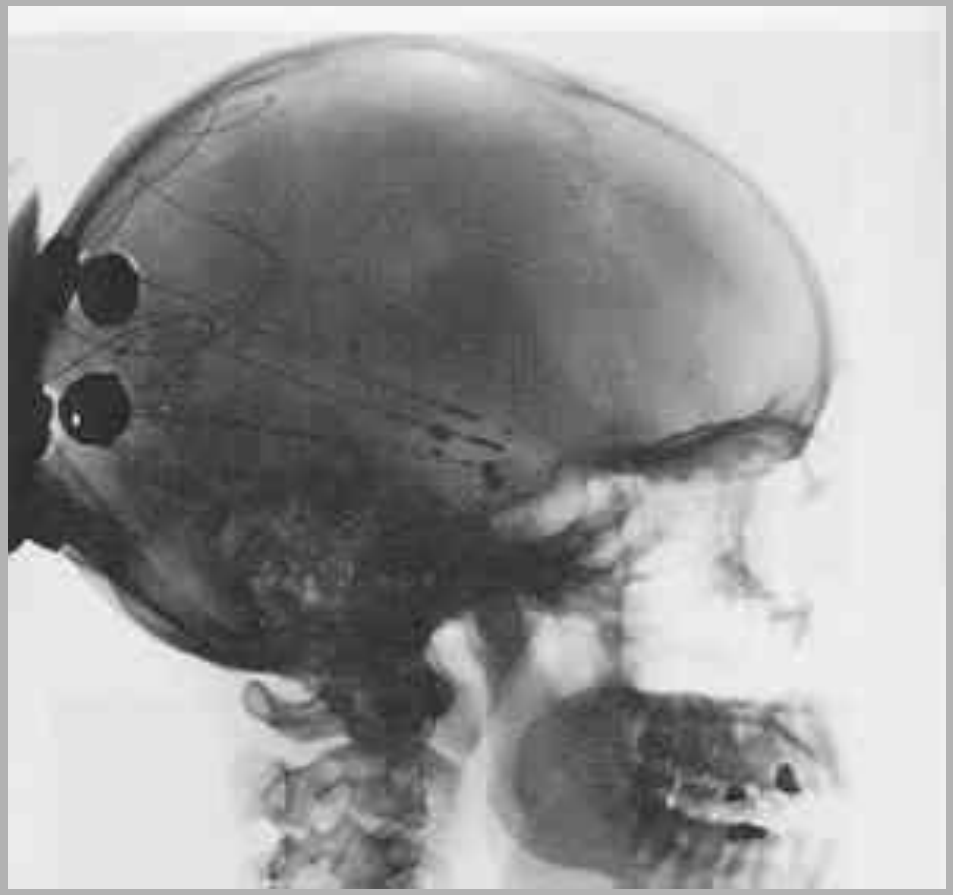
Penfield's famous sensory-motor homunculus of the human cortex – based on surface brain stimulation experiments in his clinical patients (reproduced after: F. W. Stahnisch (2010).

"Dr. Wilder Penfield (I can smell burnt toast)" – *www.histori.ca*

http://www.youtube.com/watch?v=kNdM9JhTPJw

"It has been very easy for me [Wilder Penfield], to see [Harvey] Cushing [1869–1939] following the footsteps of his master, because I had studied medicine in Oxford under [William] Osler [1849–1919] and later with [William Stewart] Halsted [1852–1922] at [Johns] Hopkins myself . It is a commonly made experience of all of us, to see in the sons [!] similar traits of the character and attitudes which bring back memories of the father. Often, until today, I see Cushing coming down the hospital corridor or I see him directly in front of me, as if he had been Osler himself, – and I also recollect his particular way of humour."

(W. Penfield, 1939, p. 1)



One of Robert Heath's patients (here a patient with schizophrenic episodes treated with deep brain stimulation) in the early 1960s

(photograph courtesy of Charles C. Thomas, Springfield, Ill)

(photograph courtesy of Charles C. Thomas, Springfield, Ill)

"One approach consists of investigating the physiological activity of certain brain regions. It necessitates, however, the availability of a technique for implantation and fixation of the electrodes in the brain, first in animals and later in human subjects. In addition, the application of electrical brain stimulation in man has been based on the data derived from animal experiments, which suggest a close relation to the electrical activity in specific brain regions with normal and pathological forms of behaviour. But even though the results from animal experimentation suggest that pathological forms of behaviour are changed by a modulating activity in locally circumscribed brain areas, we will only be able to corroborate those results found in cats and rhesus monkeys by continuing with clinical patient investigations. It is obvious, of course, that only human subjects are able to describe their thoughts and emotions in the individual test situation."

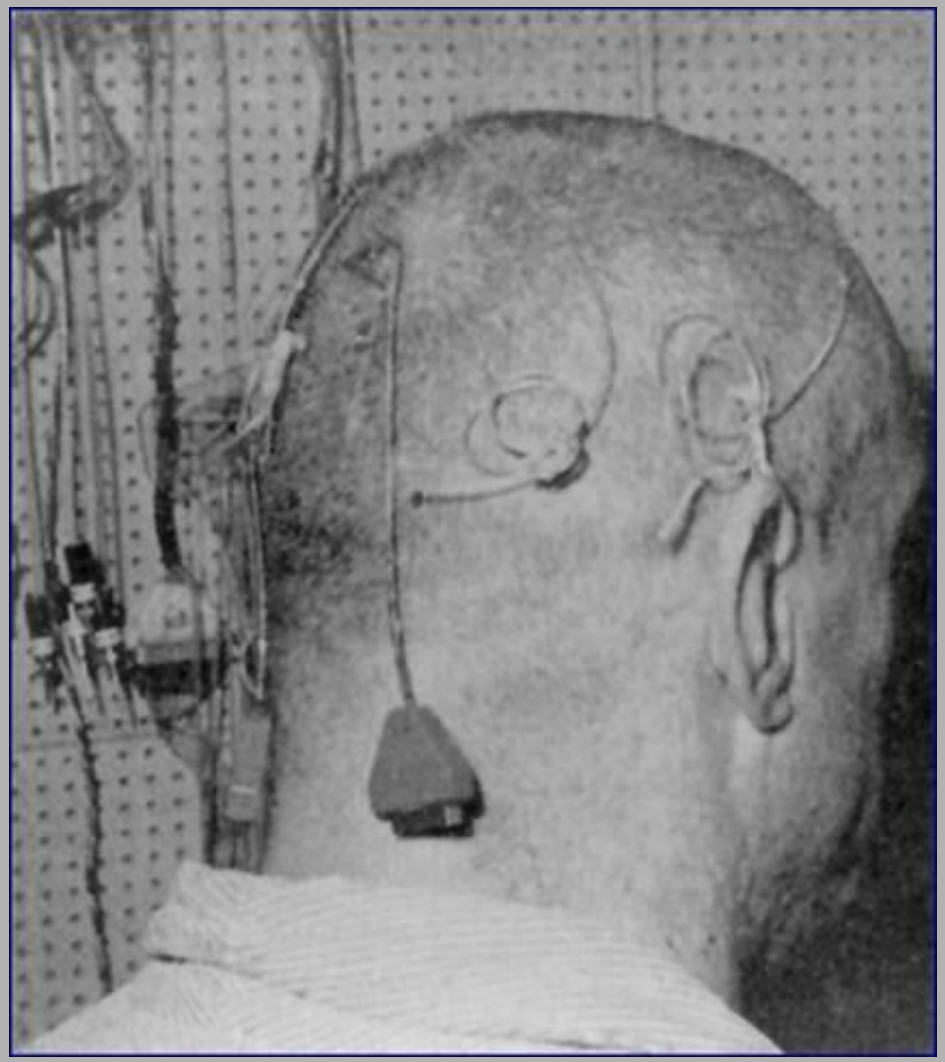
(R. Heath, NIH Report, 1957)

"In this report [one of Heath's publications], to my mind, there are clear indications that the theoretical assumptions have taken on the form of a bed of Prokrustes. The transmitted data seem to have been selected from the material in such a way, that they fit into it, if they were not altogether invented for meeting the assumptions".

(Fred Mettler, 1957)

"I [Penfield] had been very astonished, that really every time when I advanced my electrode, an answer of the patient could be elicited. How could this be? It had to do with human consciousness! I now began to perceive such answers as 'experimental' in nature and awaited to collect even more data."

(W. Penfield, 1957)



One of Heath's patients with interface electrodes placed in situ

(photograph courtesy of Charles C. Thomas, Springfield, Ill)

"Medtronic: *History of the World's Largest Medical Technology Company*"

http://www.youtube.com/watch?v=Cz7HbbWa-wE&feature=related

Some Considerations Regarding the Ethical *Problématique* of Brain Stimulation

Primary Ethical Concerns :

- There is a foundational ambivalence in therapeutic and research strategies (as a *central research dilemma*) / related to the problem of insufficient knowledge
- Conceptual fuzziness pertains to the complex relation between medical research, functional restitution, and functional aberration
- Neurostimulatory approaches change the integrity of the biological and mental "self" quite heavily; but it rests unclear whether a particular "neuro-ethics" approach exists
- Necessary and sufficient conditions for "patient autonomy" do not always appear to be clear cut (at least from a historical point of view)

"Since the role of informed consent is to protect and promote the autonomy of individuals, we can best approach the question of redesigning it by reference to the concept of autonomy.

Unfortunately, there is no agreed-upon definition of autonomy in the philosophical literature; worse, there are ongoing controversies about central aspects of it.

However, there is substantial agreement on core features of autonomy, by reference to which we can guide our reconstruction of informed consent."

(N. Levy, *Journal of Medical Ethics* (2012): Doi:10.1136/medethics-2011-100207, p. 6.)

Bibliography:

The cited literature can be retrieved through the University of Calgary Institutional Repository (dSpace) or:

The National Library of Medicine, Bethesda, MD: PubMed® Central – NCBI (NIH)